ORA TECHNOLOGIES, LLC

Coastal Impact Assessment Program (CIAP) Proposal

1. Project Title: Construction of Bioengineered Reefs to Perform as Submerged Breakwaters off of the Rockefeller Wildlife Refuge.
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4. Description and Location of Project: This project involves using bioengineered oyster reefs to serve as submerged breakwaters. A lightweight skeletal structure can be deployed in the shape of a submerged breakwater. As oysters grow, the structure will become dominated by a living reef, and wave energy in the lee of the structure will decrease. The reefs would be deployed in the Gulf of Mexico, off of the Rockefeller Wildlife Refuge in Cameron Parish. The project consists of two components, construction and monitoring. The construction component consists of designing and building 5,000-10,000 linear feet of submerged breakwater. The monitoring component consists of evaluating the ability of a bioengineered submerged reef to mitigate erosion and enhance marine habitat. The proposed project could be incorporated into, or built adjacent to CWPPRA project ME-18 Rockefeller Refuge Gulf Shoreline Stabilization. An alternative project location is between Calcasieu Pass and Johnson's Bayou.
5. Project Type: This project falls under type 1: conservation, restoration and protection of coastal areas, including wetlands.
6. Project Justification: The project is linked to CWPPRA Region 4 Strategy 15: *Stabilizing Gulf of Mexico Shoreline in the Vicinity of Rockefeller Refuge*. The Rockefeller Wildlife Refuge shoreline is currently retreating at a rate of 39ft/year. The soils seaward of the refuge can bear very little weight. A traditional rubble mound structure is likely to sink, resulting in increased construction and maintenance costs. A skeletal frame that is light enough to be supported by the local soil may decrease the cost of a breakwater significantly. Furthermore, oyster reefs are prolific fisheries habitat. The project is linked to CWPPRA Region 4 Strategy 16: *Stabilize Gulf of Mexico shoreline from Calcasieu Pass to Johnson's Bayou.*

PROBLEM

Louisiana's coastline has received national attention for the past 2-3 decades due to its rapid erosion rates. Although erosion may occur on any coastline, Louisiana suffers from some of the highest erosion rates due partly to subsidence and frequent hurricanes. Efforts addressed at limiting erosion have included a variety of solutions. These include constructed breakwaters as well as diversion spillways providing additional sediment. Poor soil load bearing capacities is

one example that could limit the use of more traditional restoration techniques along many areas of coastal Louisiana. Cost associated with project sustainability is a factor weighted in the decision for restoration project selection that could eliminate a potential project from consideration.

GOALS

The primary goal of this project is to slow or reverse shoreline retreat at the Rockefeller Wildlife Refuge in Cameron Parish, LA. The secondary goal of this project is to investigate specific designs of bioengineered reefs and their ability to mitigate erosion. Additional goals focus on environmental benefits both at the time of installation and over the development life of the oysterbreak; and investigation of stability and growth of the structures over time.

PROPOSED SOLUTION

Many locations in coastal Louisiana would be appropriate. Because this is intended to be a biologically dominated engineered structure, there is a need for sufficient oyster spat and appropriate growing conditions. The coastal area of Cameron Parish may be an appropriate site for this project. There are already other structures in the area which could be compared under similar conditions to this technology. It is expected that the oysterbreak will be deployed in shallow water off the coast, but could also be used in similar conditions in coastal bays or other waters. Data collected to date suggest that the mature structure will be comparable to traditional breakwaters, but likely much more biologically diverse. Maturity will be influenced by oyster growth rates. Thus, areas of high oyster growth would be preferred. The technology termed an "Oysterbreak" (figure 1) is designed to stimulate the growth of biological structures in the shape of submerged breakwaters. Oyster reefs can form immense structures that can protect shorelines and coastal communities from storms. One principle behind the Oysterbreak is to provide a support structure with maximum surface area for oyster establishment while maintaining its lightweight characteristics. In contrast to other artificial oyster reefs that simply provide cultch for oyster attachment, the Oysterbreak is engineered to stimulate oyster growth in a configuration that will effectively dissipate wave energy. As oysters grow on the structure, the Oysterbreak will become primarily composed of biologically created material. Another technology, termed Reef Ball™, has been used in Florida and the Bahamas as a way to establish coral reefs. Investigation on their wave dissipating effects was conducted at the U.S. Army Corps of Engineers Coastal & Hydraulic Engineering Lab. Preliminary data on the Oysterbreak technology indicates that the structures dissipate somewhat less energy than a traditional breakwater when installed, but at maturity (expected to occur between month 6 and 36) would provide erosion reduction or reversal properties similar to traditional breakwaters. Materials used are environmentally friendly (e.g. concrete, agricultural residues, oyster shell). Furthermore, because the bulk of the mature structure is biologically derived, much less initial

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material (and hence environmental impact due to heavy equipment, etc.) is needed, driving costs down. Thus, this technology is a low cost, environmentally friendly and sustainable alternative to traditional breakwaters.

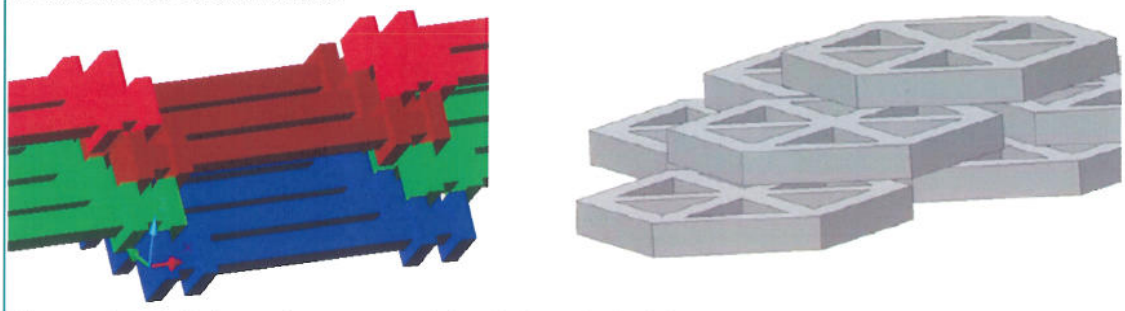

Figure 1: Modular units proposed for lightweight biologically dominated breakwater. Both are constructed from concrete containing biologically active resources and provide surface area for oysters to attach. The structural characteristics are conducive to wave dissipation.

A subsequent study concluded that the addition of cottonseed or crushed oyster shell to the concrete in the structure would increase the rate of oyster growth and reduce the time required for the structure to reach maturity.

The soils seaward of the refuge can bear very little weight. A traditional rubble mound structure is likely to sink, resulting in increased material usage and thus cost. A skeletal frame that is light enough to be supported by the local soil would require less far initial material and would be less subject to sinking. Interstitial spaces within the structure (Figure 1) will further reduce material requirements and cost. Furthermore, vertical oyster growth above the structure may offset the effects of subsidence and sea level rise.

Oyster reefs are prolific fisheries habitat. Oysters have been described as a keystone species within their habitats. As such, they provide a number of essential functions for complex communities of species. These functions include water filtering, recycling biological material, boosting benthic productivity, processing phytoplankton, and providing feeding and nesting habitat for numerous other species. Oysters serve to improve water quality by consuming phytoplankton and storing nutrients as biomass, depositing the nutrients to the benthos, or creating high quality protein (gametes and eggs) for other filter feeders. This leads to reduced turbidity and nutrient load and increased dissolved oxygen, which may in turn stimulate an increase in submerged aquatic vegetation. The oysters' role as a habitat for other species makes it extremely valuable to the commercial and recreational fishing industries.

The proposed project would be constructed off of the Rockefeller Wildlife Refuge in Cameron Parish. Ample space can be found here without oyster leases, coastal use permits or oil and gas infrastructure. The project is linked to CWPPRA Region 4 Strategy 15: *Stabilizing Gulf of Mexico Shoreline in the Vicinity of Rockefeller Refuge*. The Gulf of Mexico shoreline here is

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within 6 miles of the boat launch on LA-82. Furthermore, the Rockefeller Game Refuge is state property. This project is anticipated to benefit at least 20-40 acres of saline marsh (5,000-10,000 ln ft X 35 ft/yr X 5 yrs). According to the Marine Protected Areas website (http://www3.mpa.gov/explor einv/SiteProfile4.aspx?SiteID=LA8), the Rockefeller Wildlife Refuge is one of the most biologically diverse sites in the nation, and an important wintering site for migratory water fowl. The boat launch on LA-82 would be an adequate staging ground for manufacture and storage of the modular concrete units, and The Gulf of Mexico is directly accessible from the boat launch.

Alternately, the project can be constructed near Johnson's Bayou. The project is linked to CWPPRA Region 4 Strategy 16: *Stabilize Gulf of Mexico shoreline from Calcasieu Pass to Johnson's Bayou*. Here, Highway 82 is immediately threatened by shoreline retreat. The project area is easily accessible from Calcasieu Pass, and there is ample room for manufacture and storage of modular concrete units. Furthermore, periodic freshwater flushing due to the opening of Johnson's Bayou locks would serve to reduce predation of oysters on the Oysterbreak.

The use of lightweight biologically dominated structures may offer significant cost advantages over traditional rubble mound structures. Such a structure would be less inclined to sink in soft soils and would greatly enhance fisheries habitat. The Rockefeller Game Refuge is an important asset to the state, and in need of protection. It also offers the advantage of a convenient staging ground, close to the project site. Furthermore, the waters off of the Rockefeller Game Reserve have the necessary oyster spat concentrations, temperatures and salinities for such a project to be successful. An alternate, nearby project location is between Calcasieu Pass and Johnson's Bayou. This location also offers convenient access and adequate staging grounds. Periodic freshwater input from the Johnson's Bayou locks would increase performance of the Oysterbreak by reducing predation pressure on the oysters.

Guthrie Perry of LDWF has read this proposal and expressed his approval.

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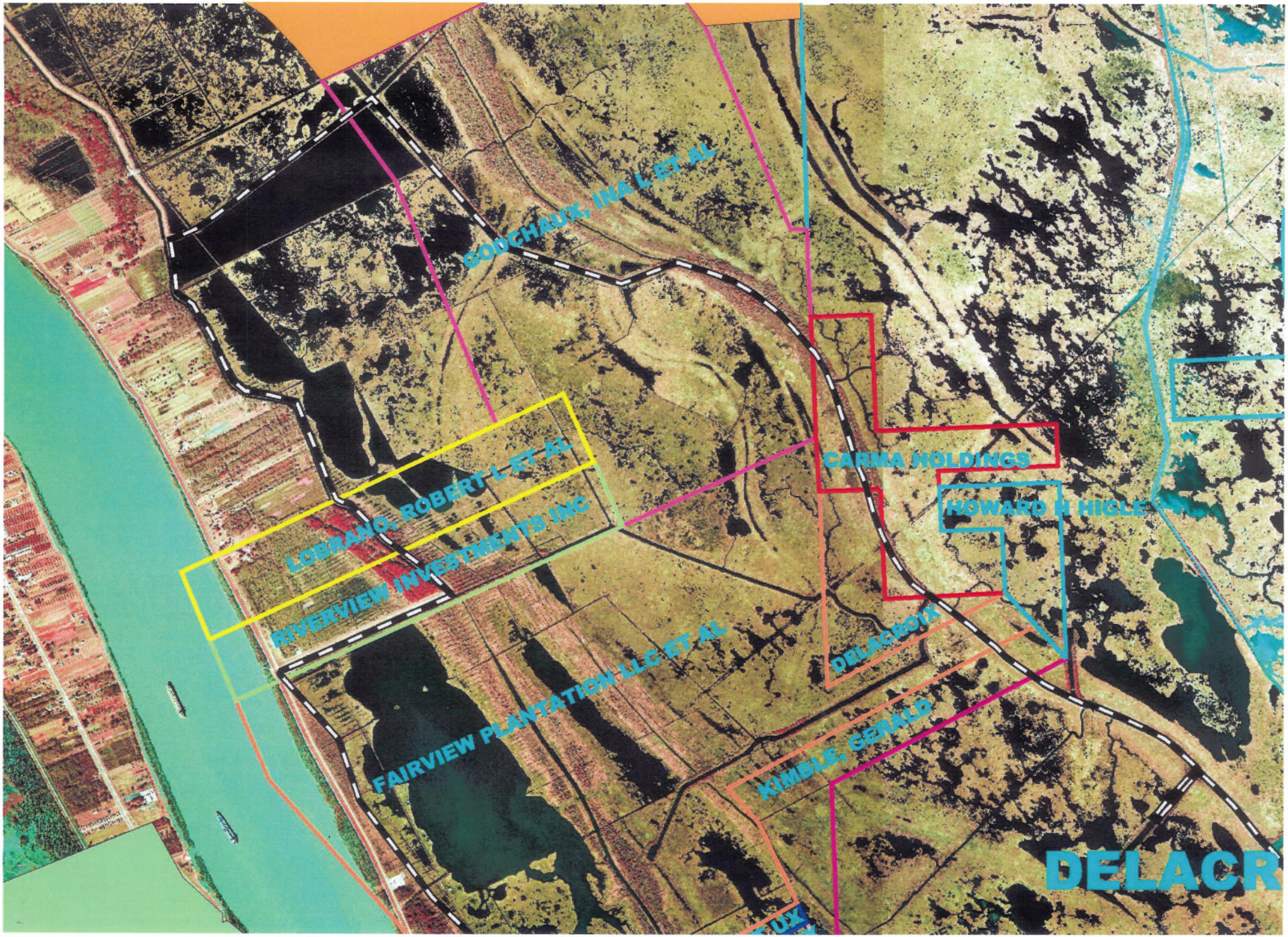
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